

May 7, 1868.

Dr. W. B. CARPENTER, Vice-President, in the Chair.

In conformity with the Statutes, the names of the Candidates recommended for election into the Society were read from the Chair, as follows :—

John Ball, Esq., M.A.	Rear-Admiral Astley Cooper Key, C.B.
Henry Charlton Bastian, M.D.	Rear-Admiral Erasmus Ommaney, C.B.
Lieut.-Colonel John Cameron, R.E.	James Bell Pettigrew, M.D.
Prof. R. Bellamy Clifton, M.A.	Edward James Stone, Esq., M.A.
Morgan William Crofton, Esq., B.A.	Rev. Henry Baker Tristram, M.A.
Joseph Barnard Davis, M.D.	William Sandys Wright Vaux, Esq., M.A.
P. Martin Duncan, M.B.	
Peter Griess, Esq.	
Augustus George Vernon Harcourt, Esq.	

The following communications were read :—

- I. "Researches on the Blood.—On the Action of Nitrites on the Blood." By ARTHUR GAMGEE, M.D., F.R.S.E., Assistant to the Professor of Medical Jurisprudence in the University of Edinburgh. Communicated by Prof. FRANKLAND, F.R.S.
Received April 1, 1868.

(Abstract.)

The paper commences with a statement of the facts with which we are at present acquainted, relating to the nature and character of the blood-colouring-matter, and its relation to gases.

I. The action of nitrites in modifying the colour and spectrum of blood is then described. Under the influence of nitrites, arterial blood assumes a chocolate coloration. Coincidentally the bands of scarlet cruorine (or oxidized hæmoglobin) become very faint, and an additional absorption band, occupying the same position as that of acid hæmatin, appears. The addition of ammonia to blood in which nitrites have induced the characteristic change of colour and spectrum, causes the red colour to return and gives rise to a new spectrum in which the normal blood-bands are again better defined, but accompanied by a faint and rather undefined absorption band in the orange. It appears from the experiments of the author that the change in optical properties induced by ammonia is not due to any decomposing action exerted upon the body formed under the influence of nitrites; for on neutralizing the solution to which ammonia has been added, the original spectrum is reproduced. When sulphide of ammonium, or a reducing-solution of iron is added to a blood solution which has been acted upon by nitrites, all effects of their action disappear, and the solution again possesses the spectrum of oxidized blood-colouring-matter, although precau-

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tions have been taken to exclude atmospheric air. The continued action of the reducing-solution then leads to the reduction of the blood-colouring-matter, which when shaken with air again yields the perfectly normal spectrum of blood. It would therefore appear that when nitrites act upon the blood-colouring-matter they do not *decompose* it, nor thrust out or remove the loose oxygen with which it is combined.

II. The author then describes a series of experiments instituted with the object of determining whether blood which has been acted upon by nitrites has lost its power of combining with the atmospheric oxygen. The apparatus and methods used are described, and it is shown that the amount of oxygen which nitrite-blood absorbs is much smaller than that absorbed by normal blood.

III. In the next series of experiments the author made use of carbonic oxide gas as a reagent to indicate whether after the action of nitrites the loose oxygen of the colouring-matter is still capable of expulsion by CO. With this object the blood was arterialized by agitation with air and treated with a solution of a nitrite. After some time it was brought in contact with a measured volume of pure carbonic oxide; after being well agitated and allowed to remain in contact with it for some time, the gas was removed and analyzed. It was found in these experiments that, after the action of nitrites, the loose oxygen of the blood-colouring-matter (which the observations mentioned under I. had been shown to be neither expelled nor taken possession of by the nitrite) was so locked up as to be irremovable by carbonic oxide.

IV. The methods which have been employed by other observers for removing the gases from the blood are then examined, and the author describes the way in which he employed Sprengel's mercurial aspirator to effect the object which he had in view. He shows that with this instrument and following his method, the gases of the blood may be separated by boiling *in vacuo* during twenty-five or thirty minutes.

The gases of both normal blood and blood treated with nitrites were boiled out *in vacuo*, their amount estimated, and their composition determined. It is shown that when blood has been acted upon by a nitrite, the amount of oxygen which can be removed by ebullition in a very perfect vacuum is immensely diminished, the greatest difference being perceived when the nitrite had been in contact with the blood during the longest period of time.

V. Although blood which has been acted upon by nitrites has, to a great extent, lost its power of absorbing oxygen, it still retains the property which normal blood possesses of ozonizing the atmospheric oxygen. Nitrite-blood reacts with guaiacum paper exactly like normal blood, and when added to a solution of peroxide of hydrogen, it causes an evolution of oxygen.

VI. The changes in the optical properties of blood are shown to be due to the formation of compounds of the nitrite used with oxidized hæmoglobin; these compounds, with the exception of that with nitrite of silver,

present the same crystalline form, colour, and spectrum, whatever the nitrite which has been employed. The author has obtained compounds of hæmoglobin with nitrite of sodium, potassium and silver, and with nitrite of amyl. The methods of preparing them are described, and the results of analysis given; these show that the amount of a nitrite which adds itself to oxidized hæmoglobin varies considerably.

Having stated the conclusions which he thinks may legitimately be drawn from his investigations, the author concludes by making some observations upon the relation which the compounds of nitrites with hæmoglobin bear to the previously known hæmoglobin compounds.

We have hitherto been acquainted with hæmoglobin itself, as well as with its O, CO, and N_2O_2 compounds.

These compounds are all isomorphous, and possess almost the same physical characters; in each of them hæmoglobin free from oxygen (*i. e.* reduced hæmoglobin) has apparently linked to it a molecule of O, CO, or N_2O_2 respectively, the stability of the compound being least in the case of the O, and greatest in that of the N_2O_2 compound. All these bodies, and preeminently the O compound, are examples of a class of bodies which stand, as it were, on the boundary line which separates chemical from physical combination, being examples of the class to which the term "molecular compounds" has been given. Like other molecular compounds, their composition varies extraordinarily within certain limits, and is influenced by circumstances and conditions which have no action on chemical compounds proper.

That a body possessing such a very complicated molecular structure as hæmoglobin should present numerous points of attachment, as it were, for the linking on of such active condensed bodies as the nitrites is not improbable; nor is it remarkable that, as in the case of other combinations "of a molecular kind," such as the union of salts with their water of crystallization, of sugar with bases, of albumen with metallic oxides, of the compound ammonias with iodine, the amount of the new and more simple body added to the hæmoglobin should vary within wide limits.

Simultaneously with the researches which the author has conducted on the action of nitrites on blood, those now being made by Hoppe Seyler * and Preyer †, although discrepant in many particulars, seem to show that hydrocyanic acid possesses, like nitrites, the power of linking itself to oxidized hæmoglobin, forming a body which is isomorphous with it, but possessing a different absorption spectrum, and incapable of absorbing oxygen.

This body appears not to possess the power of ozonizing the atmospheric oxygen, a fact which is strange, as, besides being possessed by the O com-

* Medicinisch-chemische Untersuchungen. Zweiter Heft, 1867, Cyanwasserstoffhämoglobinverbindungen, p. 201.

† Die Ursache der Giftigkeit des Cyankalium und der Blausäure, von W. Preyer. Virchow's Archiv, Bd. xl. 21 Hft. Sept. 1867.

pound, this property is also possessed by the CO and N_2O_3 compounds of hæmoglobin, as well as by the nitrite compounds of oxidized hæmoglobin. It is probable that we may now find that a large number of condensed bodies have the property, like the nitrites, of forming combinations with the blood-colouring-matter.

- II. "Microscopical characters of the rhythmically contractile Muscular Coat of the Veins of the Bat's Wing, of the Lymphatic Hearts of the Frog, and of the Caudal Heart of the Eel. In Three Parts.—Part I. Microscopical characters of the rhythmically contractile Muscular Coat of the Veins of the Web of the Bat's Wing." By THOMAS WHARTON JONES, F.R.S., Professor of Ophthalmic Medicine and Surgery in University College, &c. Received April 8, 1868.

(Abstract.)

This is Part I., of a series of three, of a paper on the microscopical characters of rhythmically contractile muscular tissue, other than that of the blood-heart. It comprises a reexamination of the microscopical characters of the *rhythmically* contractile muscular coat of the veins of the bat's wing, and is offered by the author as Appendix No. 3 to his paper in the Philosophical Transactions for 1852, entitled "Discovery that the veins of the Bat's Wing (which are furnished with valves) are endowed with rhythmical contractility, and that the onward flow of the blood is accelerated by each contraction." This reexamination supplies additional details, illustrated by more correct figures, confirmatory of the author's previous description of the microscopical characters of the muscular coat of the veins of the bat's wing. The author examines also, by way of comparison, the *tonically* contractile muscular coat of the arteries, and points out that, though the fibrils of the muscular coat of the veins do not present transverse markings, they differ in their microscopical characters as much from the fibrils of the muscular coat of the arteries, as the transversely striped muscular fibrils of the bat's heart do from them. He insists, therefore, in conclusion, that there are no grounds for an implied physiological form of the doctrine of isomerism, viz. similarity of structure, with different endowments.

- Part II. "Microscopical characters of the rhythmically contractile Muscular Coat of the Lymphatic Hearts of the Frog." Received April 13, 1868.

The author, in this second part of his paper, first calls attention to the fact that, on viewing the anterior lymphatic heart from the front, after dissecting down upon it from the back, he sometimes found its cavity filled with air or blood. The way by which the air or blood had entered